Temperature dependence of resonance Raman of single-walled carbon nanotubes

Shohei Chiashi, Mototeru Oba and Shigeo Maruyama

Raman scattering from single-walled carbon nanotube (SWNT) samples at various temperatures (4~1000 K) in vacuum are measured. The G-band peak exhibited temperature dependence in Raman shift, peak width and intensity. Especially, Raman shift of the G+ peak showed universal temperature dependence, for the various SWNT samples and for excitation lasers with 3 wavelengths (488.0, 514.5 and 632.8 nm).

On the other hand, some of radial breathing mode (RBM) peaks showed anonymous temperature dependence. With increasing temperature, Raman shift of all RBM peak downshifted and the peak width increased. The intensity of most RBM peaks uniformly decreased with increasing temperature, while that of some RBM peaks increased. The intensity of the RBM peaks that increased with increasing temperature was very small at the room temperature and these peaks could not be observed at all from SWNTs dispersed in solution.

These anonymous RBM features are explained by the transitions by cross-polarized excitation. This enhancement of resonance of cross-polarized absorption at higher temperatures will be discussed in term of the change of the electronic density of states.